



**DEPARTMENT OF AGRICULTURE,  
CEYLON.**

**BULLETIN** No. 38.

**IMPROVED METHODS FOR GROWING  
TOBACCO IN JAFFNA.**

***W. P. A. COOKE,***

*Lecturer, School of Agriculture, Peradeniya.*

Peradeniya,

July, 1918.

COLOMBO:

**H. C. COTTLER, GOVERNMENT PRINTER, CEYLON.**

1918.

STAFF OF DEPARTMENT OF AGRICULTURE, CEYLON,		
F. A. STOCKDALE, M.A. (Cantab.), F.L.S.	<i>Director of Agriculture.</i>	
T. PETCH, B.A., B.Sc.	..	Botanist and Mycologist.
G. BRYCE, B.Sc.*	..	Asst. Botanist and Mycologist.
M. K. BAMBER, M.R.A.C., F.I.C., F.C.S.	..	Government Chemist.
E. R. SPEYER, M.A., F.E.S.	..	Acting Entomologist.
N. K. JARDINE, F.E.S.	..	Entomologist for Tea Tortrix.
G. M. HENRY ..	..	Assistant Entomologist.
C. DREIBERG, B.A., F.H.A.S.	..	Supt. of Low-country Products & School Gardens (on leave).
H. A. DEUTROM	..	Acting Manager, Peradeniya Experiment Station.
G. HARBORD* ..	..	Manager, Dry Zone Experi- ment Station.
H. F. MACMILLAN, F.L.S.	..	Superintendent of Botanic Gardens.
F.R.H.S.		
T. H. PARSONS*	..	Curator, Royal Botanic Gardens, Peradeniya.
J. J. NOCK ..	..	Curator, Botanic Gardens, Hak-
R. H. PEREIRA ..	..	Chief Clerk. [gala.
ALEXANDER PERERA	..	
D. D. FERNANDO	..	
C. WICKREMARATNE	..	
N. WICKREMARATNE	..	
A. DE ALWIS ..	..	Secretary, Board of Control, Co-operative Credit Societies.
B. D. PERERA ..	..	Draughtsman.
D. F. DE SILVA GUNARATNE	..	Librarian.
T. YOUNG ..	..	Conductor, Henaragoda.
GEO. SCHRADER	..	Conductor, Nuwara Eliya.
J. M. SILVA ..	..	Conductor, Chilaw Coconut Plant Collector. [Trial Ground.

\* On Military service.

#### COMMITTEE OF AGRICULTURAL EXPERIMENTS.

Director of Agriculture,	<i>Chairman.</i>
Botanist and Mycologist.	Mr. N. G. Campbell.
Government Chemist.	Mr. J. B. Coles.
Rubber Research Chemist.	Mr. R. G. Coombe.
Entomologist.	Mr. A. J. Austin Dickson.
Superintendent, Botanic Gardens	Lieut.-Col. W. G. B. Dickson.
Superintendent, Low-country Products and School Gardens.	Mr. H. D. Garrick.
Govt. Agent, Central Province.	Mr. G. H. Gollidge.
Assistant Government Agent, Puttalam.	Mr. E. W. Keith.
Rural Member of the Legislative Council.	Mr. A. S. Long-Price.
Chairman, Planters' Association.	Mr. N. J. Martin.
Chairman, Low-country Pro- ducts Association of Ceylon.	Mr. G. H. Masefield.
Mr. William Sinclair.	Mr. C. E. G. Panditsekere.
Mr. A. W. Beven.	Mr. J. S. Patterson.
	Mr. M. L. Wilkins.
	Mr. T. Y. Wright.
	Sir Solomon Dias Bandaranaike
	Kt., C.M.G.
	Manager, Peradeniya Experiment Station, <i>Secretary.</i>

DEPARTMENT OF AGRICULTURE, CEYLON.

BULLETIN NO. 38.

IMPROVED METHODS FOR GROWING  
TOBACCO IN JAFFNA.

SEASON FOR JAFFNA.

**G**HE experience of the three years' cropping seems to point that any time between September 25 to October 25 is the most opportune for sowing nurseries. During this period the nurseries should be sown at intervals of about ten days to ensure seedlings of the proper size for transplanting to range over a period of one month, since one has to anticipate periods in November and December when the weather turns out to be too wet to permit of any field operations. The size of seedlings for transplanting is of importance, and will be referred to in the section dealing with this operation.

The advantages of sowing in September-October are that the crop is ready for planting from November 25 to the end of December. During this period the weather is cloudy, and the task of transplanting is made easy. Thus, early planting means a saving of seedlings, for comparatively few fail to become established. The plants will not require watering, as a rule, until the end of the first week in January. This means a saving of labour, and hence a corresponding saving of money.

By about January 10 the crop will be about a month old in the field, and will allow of channel irrigation. This ought to be carried on for a further period of about 2 or  $2\frac{1}{2}$  months, after which the crop will be ready for harvesting.

There is another more weighty consideration which ought to recommend early sowing. Tobacco grown in cool weather burns better than that grown in hot weather. Experience at the trial ground at Jaffna confirms this view. The crop that was sown during the last week in September and transplanted

during the latter part of November burned much better than the previous year's crop, which was planted in January.

The early morning dew in January and February is good for the plants. This favours the growth of a good-sized crop, which thereby increases the yield per acre. Comparatively few lower leaves get dried and become useless.

The only drawback which one has to face in maintaining a nursery in wet weather is combating a fungus disease, which causes the " damping off " of seedlings.

#### SELECTION OF SITE FOR NURSERIES.

A raised piece of ground protected from wind and free from shade will suit well. Tobacco seedlings are very tender, and will not tolerate a strong breeze. The dry south-west wind is most damaging in its effect, while the moist, cool north-east wind does not appear to affect seedlings very much. Protection should, therefore, be against the south-west wind.

The presence of sunlight is an important factor in germination and vigorous growth of seedlings. An adjoining cultivator sowed a nursery which was shaded in the mornings by a coconut tree. The germination was quick, but the growth was very disappointing. He had to sow a new nursery bed.

The nurseries should be located in raised grounds, as it ensures proper drainage and keeps the beds free from excess of moisture. Dampness and insufficient drainage causes fungus attack, and slow and weak growth of seedlings.

The texture of the soil is another important factor. A soft friable virgin soil, rich in organic matter, ought to be preferred. In hard, heavy clay soils the seedlings become stunted, owing to the roots being unable to get deep into the soil. The result is that the roots lie on the surface, run into the roots of the neighbouring seedlings, and are curved and bent. The tap root should be straight, and must run deep into the bed.

#### PREPARATION OF SEED BEDS.

The nursery beds should be prepared about a month before sowing. The soil should be dug to a depth of 6 inches to 8 inches, and well pulverized. After digging, beds in rows should be prepared to a size of 3 feet by 6 feet. The breadth of

3 feet is convenient in handling the bed from either side both for watering and weeding. The rows should be separated by a drain or a footpath about 15 inches wide for the coolies to walk on while watering or weeding. It is absolutely necessary to keep the surface of beds quite even. If depressions are left the sprinkled water washes the soil and seeds from raised parts to the depressions and thereby spoils the nursery. The manure should be applied immediately after preparing the beds. A country basket full of well-powdered cattle manure will be sufficient for a 3 feet by 6 feet bed. It is not at all safe to leave pieces of cattle manure to lie on the surface. These retain moisture, and may encourage fungus growth.

#### PRECAUTION AGAINST FUNGUS ATTACK.

If the bed is known to be infected with fungus spores, the best method to sterilize the soil is to apply boiling water until the temperature at a depth of 6 inches rises to above 90° Centigrade. Burning the soil is not effective, unless it is thoroughly and carefully carried out, as only the surface is heated, and sufficient heat does not reach the lower layers.

#### SEEDS FOR SOWING.

The individual seeds in seed heads are not of the same size and weight, nor of the same degree of ripeness. The seed should be separated in a seed-grading machine. It is very important to have full matured heavy seed to ensure uniform, good-sized plants. If every plant in the field be well grown, the yield will be greater, and therefore it pays one better to get the seed graded and sow only the best seed. At present the cultivator sows too large an amount of seed in his bed, and finds seed germinating from the sixth day to the time he transplants his crop. Undoubtedly this helps him to get seedlings of desired size for a long range of time, but the seedlings are weakly from being crowded, and do not possess uniform vitality, as they have grown from various grades of seed. The cultivator should sow graded seed at various intervals and grow strong uniform seedlings. He at present saves one of his best plants for seed, and all the seed from that plant is sown in one bed about 5 feet by 10 feet,

whereas a teaspoonful of graded seed is sown to about 100 square feet at the trial grounds. This amount will be sufficient to raise seedlings to plant one acre of land.

If too much seed is used, the seedlings become over-crowded, and they will not thrive well when transplanted. A good supply of seedlings should be raised. A good bed 3 feet by 6 feet may supply as many as 300 to 400 plants in two or three drawings, but it is not safe to count on more than 150 to 200 plants from each 3 feet by 6 feet sowed.

#### METHOD OF SOWING.

The nurseries prepared a month before would have the weed seeds germinated, and the plots will be weedy at the time of sowing. The bed should be stirred to 2 inches to 3 inches deep and the weeds removed. The seed to be sown should be thoroughly mixed with bulky material, such as fine sand or wood ashes or dry fertilizer. The amount of sand or wood ashes should be just sufficient to spread evenly over the bed. It might be necessary to go over the bed a second time to ensure an even distribution. The best method to cover the seed is by trampling with the feet. This compacts the soil at the surface and presses the seed slightly into it. The compact top surface prevents washing away of seedlings during heavy showers. The compactness decreases the space between soil particles, connects the moisture of the lower layer with the top, and thereby keeps the seed moist. The moisture helps the germination of the seeds. Tobacco seeds under very suitable conditions germinate in six days.

#### SHADING THE NURSERY.

After sowing the seed the bed should be covered if the weather is hot. The usual practice is to cover with twigs. This is a dangerous practice, as it attracts insects, which feed on the seedlings when they germinate. A safer plan is to cover with cadjans after 9 A.M. and uncover at 5 P.M.

#### WATERING THE BEDS.

The cultivator in Ceylon waters his crops by rule-of-thumb method. The rule with him is to water the nursery both morning and evening. Supposing there was rain in the

morning providing sufficient moisture for the day, if the weather cleared in the afternoon he will water again. The object of watering the bed is to keep the surface moist in order to help the germination of the seeds, and later to keep sufficient moisture in the soil for the seedlings as they grow. The two extremes of dryness and dampness should be avoided. The cultivator errs in keeping his bed too damp. Dampness encourages fungus activity, and is the forerunner of the " damping off " disease. Water is best applied by means of a fine rose-sprinkling can. This does not injure the seedlings, and does not encourage baking of the soil by packing the surface. Three gallons of water is sufficient for 36 square feet for the day in dry weather. After the seedlings begin to grow the quantity should be reduced. The best time for watering is after 4 o'clock in the evening. If watered in the mornings the water remains on the leaves, and the leaves are scalded by the heat of the sun. Weeding should be done with the hands, and the disturbed soil should be lightly pressed and water-sprinkled.

#### FUNGUS DISEASE.

The damping-off disease appears when the seedlings are crowded and the bed is too damp. The watering should be stopped till the bed gets dry, and water should be applied very sparingly.

Prevention is, however, better than cure. Strong seedlings resist the attack better. This is secured by "pricking" the seedlings.

#### "PRICKING OF SEEDLINGS IN NURSERY."

This means the re-setting of seedlings in the nursery when they are about a fortnight old and after the shoot begins to grow. This is distinct from the operation of transplanting in the field when plants are nearly fifty days old. The advantage of re-setting is undoubtedly known to the practical grower. The "pricked" plants resist the disease and stand transplanting better. They start to grow almost immediately after transplanting, and the number of days for them to mature in the field is decreased by about fifteen days, with a corresponding saving on the cost of production.

When growing shoots appear, the seedlings are removed from beds with their roots undisturbed. This is ensured by taking them up with the soil to a depth of  $1\frac{1}{2}$  inches or 2 inches with a mamoty or with a fine-edged flat plate. The operation is preferably carried out by boys. The seedlings are separated and planted in rows, 1 inch by  $1\frac{1}{2}$  inches. Care must be taken that the transplanter does not trample the bed. For this purpose he ought to tread over a board on the bed, so that his weight is evenly distributed on the surface. The operation should be carried out in the evening after 5 o'clock, and water should be sprinkled immediately after setting. The seedlings readily re-establish themselves, and stand subsequent transplanting in the field better than "unpricked" plants.

#### PREPARATION OF THE SOIL.

The time for cultivating the soil for the main crop will depend upon the month during which the inter-crop is harvested. Tobacco land carries either two inferior grain crops in succession, or chillies or brinjals. It is also rotated with manioc. The cultivator combines the manuring with cultivation. He has a movable cattle shed, in which he keeps three or four cattle. He moves this daily from one spot to another until the whole field is covered. Every day after shifting his shed he digs up and mixes the manure, which includes both the dung and urine. This is undoubtedly the most effective way to save all the cattle manure. In addition, he buries tulip leaves or other green manures. This gives a second cultivation, and the land is ready for planting. The rich organic manure thus applied produces a coarse, thick-veined, rank tobacco.

There is much room for investigation into the correct application of manures now in use, and the advisability or otherwise of supplementing these with artificial manures, the expense of which will be consistent with the outturn. The manure at present applied at the trial grounds per acre is 30 lb. of nitrogen in the form of nitrate of soda, 54 lb. of phosphoric acid in the form of superphosphate, and 98 lb. of potash in the form of potassium sulphate or wood ashes.

The soil should be ploughed to a depth of 6 inches to 8 inches by a light iron soil-turning plough. Either the "Pony" plough or the "Hindustan" plough would serve the purpose well. Though the initial cost of the iron plough is higher than that of the local plough, in the long run it will be found cheaper than the wooden plough, which gets wasted soon, and requires the assistance of digging. If the iron plough be not used, the soil should be dug deep in October. The rains in November soak into the soil and are preserved for the use of the plants later. If left unploughed before the rains, much of the rain water runs off the hard surface, and only a small quantity is absorbed into the soil. Just before planting manure should be spread, and the soil should be given a light stirring with a country plough and be levelled with a flat board. The board should be about 4 feet by 3 feet. To this a rope or a chain is attached and thus yoked to the bulls. A man stands on the board and is drawn round the field in the manner of ploughing. The field is then lined 3 feet by 3 feet for the rows of plants.

#### TRANSPLANTING.

A cloudy day should be selected for transplanting. The beds from which the plants are to be drawn should be well watered to soften the soil and to allow of plants being pulled with little damage to the roots. The roots should, as far as is possible, be removed entire without damage to rootlets. The shock in transplanting is due to the severance of root hairs from the roots, and consequently the plant wilts, and only recovers after new root hairs are formed. Plants are best pulled with a thin-pointed wooden peg. This should be pressed into the soil to a depth of about 3 inches or more at intervals of about 4 inches. In "pricked" beds the plants are removed easily as they stand in rows. Here they need not be pulled, but they are removed by rows sideways with the soil by means of a thin plate. The plants when removed are put into baskets, and should not be exposed to the sun. Only as many plants ought to be removed at a time as can be planted in one or two hours.

A strong-pointed wooden peg a foot long is used by the transplanter. He digs and stirs the soil 6 inches by 6 inches

and 9 inches deep. The hole is filled again, gently tapped with the palm, and a hole is opened with the fore-finger or the wooden peg. The leaves of seedlings are raised up to protect the bud during the operation, and the tap root and secondary roots are brought together gently and inserted into the hole. The soil is now pressed from the sides with the fingers of both hands and the plant is fixed. Less pressure is required if the soil is wet. It is essential to fix the tap root in the position in which it grew in the bed. Any bending must be avoided. The bending of the tap root in transplanting is the main cause of many failures. If the tap root be unmanageably long, it is safer to cut a part of it before replanting.

Throughout transplanting the chief object to be kept in view is that a uniform crop must be ultimately secured. This can only be obtained by skill in transplanting. Only experienced men should be employed. If a uniform stand be not secured, a sacrifice of plants will result at harvest. Some will be far advanced, when others are still green. The cured product of such a crop is not uniform, and therefore fetches a low price in the market; hence an irregular stand of plants does not pay the cultivator. Securing a uniform crop is an art in itself. It depends on the skill in the raising and transplanting of seedlings.

#### TREATMENT OF NURSERIES BEFORE TRANSPLANTING.

The plants should not be watered frequently. The bed should be allowed to get fairly dry for some time immediately before transplanting. This treatment hardens the plant, and helps it to stand the shock of transplanting.

#### THE TIME OF TRANSPLANTING.

The seedlings are pulled off the nursery at about 3.30 P.M., and the planting starts at 4 P.M., or even later, depending on the heat of the day. The transplanting should not be carried out in the mornings, except when cloudy. The night's dew keeps the plants from wilting overnight, and enables them to stand the sun on the day following. Therefore evening is the best time for transplanting.

## SELECTION OF SEEDLINGS.

Only strong stalky plants ought to be selected for transplanting; spindly seedlings usually do not begin to grow quickly after transplanting, and produce delicate and small plants, which are not worth the trouble of harvesting and curing. The stem should be examined for any insect attack, as the stem-boring insects often enter the seedlings while in the nursery. There is also a fungus which attacks the stem. This is known as "black stem disease." Its presence is indicated by a black streak on the stalk. Such seedlings look healthy and strong, but when planted they get stunted. The roots ought to be bushy, and the tap root strong and almost straight. Sometimes the roots bear nodules, due to the irritation caused by eelworms or other agency. Such plants should be discarded.

The size of the plant is an important factor. If the seedlings are small, they require much attention. They need to be shaded and watered frequently. If too large, the seedling has no chance of growing to its full size, nor does it stand transplanting well. The right plants for transplanting are those whose longest leaves are 4 inches to 5 inches. The length of the stem does not indicate the age of the plant, as different varieties have different lengths of stalk. Last season plants of various sizes were planted on one plot. The bigger plants were stunted, and these were pulled out. The right-sized plants grew rapidly, and eventually became the largest plants in the plots. They were ready for harvesting earlier than the plants which were originally small.

## TREATMENT AFTER TRANSPLANTING.

A small quantity of water should be applied in case the soil is dry. No shading is required, as the leaves protect the bud, and no direct ray of sunlight falls on the leaves, as the leaves are fixed vertically upwards, covering and thus protecting the bud. This is an improvement on the local method. The important point to remember is that seedlings when transplanted receive a shock. This is greatly minimized by following the directions mentioned above. The seedlings establish themselves by taking plant food and water from

the soil. Their treatment accordingly should be carefully attended to. It is a mistake to supply too much water at this time. The plants require only just enough water to regain their condition in the nursery and to begin to grow. For a period of one month after planting the plants should be given just enough water to maintain their life. This treatment induces a healthy root development, and the root system spreads deep into the soil in search of plant food. The opportunity to encourage an enlarged root system at this period of its life should not be missed. An experiment was tried in the second season to determine what interval was best for watering. Some transplanted plants were watered both morning and evening, as was done locally. Some once a day, some once in two days, some once in three days, some once in four days, some once in five days, and some once in six days. The plants were found to do better as the frequency of watering was decreased to once in four days, and declined from this period. Those watered more frequently made slow growth, and were shallow rooted. The best method of watering during the first month is as follows:—One man digs a small hole 6 inches deep beside each plant; another follows carrying water and fills each hole in succession; a third man follows covering up these holes as the water is soaked into the soil. At the second watering the operation is carried out on the opposite side of the plants. This method serves two purposes, viz., watering and cultivation. Objection to the local method of watering on the surface is that the soil gets baked up, a hard crust is formed, and the moisture is not retained, but is quickly evaporated at the surface. The advantages of the methods recommended are that the water is applied close to the roots, the soil loosely re-filled into the holes serves as a mulch, minimizes soil evaporation, keeps the soil cool, and encourages deepening of the root system. This deepening of the roots makes it safe to water less frequently, since the lower layers of the soil retain moisture for a longer period.

#### CULTIVATION.

Ten days after transplanting the land between the rows should be cultivated once or twice with a Planet Junior

cultivator to keep the soil in good tilth, and to conserve the soil moisture. About a month after transplanting the plants require more water, and this is the time they grow most rapidly. Now narrow channels are opened on one side of each row. For the second watering channels are opened on the opposite side. Gradually these channels are made broader and farther away from the rows, until one channel serves to water two rows. Three days after each watering the soil is cultivated crosswise with the cultivator. The bulls are driven between rows, one man on either side of the yoke directing them. Care should be taken that the leaves are not damaged in the operation. When the plants have leaves spreading on either side preventing the operation, the cultivation should be stopped. At this time the leaves shade the ground, and no cultivation is required. The plants are watered once in eight to ten days. The local practice is to water once in two days. The local variety of tobacco was cultivated at the trial ground according to the system outlined above on one-third acre. A larger yield resulted than was obtained on the surrounding fields.

#### TOPPING.

The plants are topped after flower heads begin to appear. The plant at the time of flowering uses all the plant food it receives from the soil to produce the flower and seeds, thereby starving the leaves. If the flower heads are removed at the time of their appearance, the food material is utilized by the leaves and a heavier yield is thereby obtained. In the case of plants which grow coarser and thicker leaves than is desired, the plants are not topped. If the leaves are very small and thin, the plants are topped low, leaving only a few leaves to mature. If the plants are of medium growth, the plants are topped at such heights as when harvesting the leaves may more or less be of the same degree of ripeness.

#### SUCKERING.

The plants when topped put out new shoots at the bases of leaves and try to seed again. These shoots appear a few

days after topping, and should be removed as they appear. This operation requires to be repeated three or more times according to the vigour of the plants.

#### SELECTION AND CARE OF SEED PLANTS.

Before topping the field should be gone over several times, and a few of the best plants should be selected for seed. The best plants are those which are strong, vigorous, and healthy, with thick stems, broad long leaves with fine veins, and with leaves placed near each other on the stem, neither drooping nor standing up. The seed head should be covered with a paper bag, or with bags made of cheese cloth, to prevent cross pollination. Seeds formed by self-pollination produce uniform and vigorous seedlings, which retain the characters of its parent. Before bagging, the flowers which have already opened should be removed, and every week the head should be examined and thinned out by removing small and undesirable capsules. The leaves of these plants should not be harvested. The heads are ready for harvesting after they turn brown. The seeds should be carefully preserved and graded before being used for the next season.

#### CULTIVATION FOR DIFFERENT TYPES.

The cultivation methods given above will have to be modified to suit the varieties of tobacco which are used for different purposes. In Ceylon, tobacco is mainly grown for cigars and for chewing. No attempt is made to breed or grow tobacco for special purposes as in other countries, though the tobacco grown in certain soils retains certain characteristics, which are preferred by consumers in different parts of the Island and Travancore. In order to get a fine textured elastic leaf to serve as wrappers in cigars, the plants ought to be encouraged to grow rapidly; for this purpose the land should be liberally manured, and more frequent cultivation and watering is advised. The plants should be topped after the seed head is formed. Sometimes it is advisable not to top at all. To ensure a bright colour and soft texture the leaves ought to be harvested when just mature.

The "general purpose tobacco," which serves as wrapper, cover, and filler, ought to be given the same treatment as above, but topped a little earlier in order to induce growth of big-sized but thin leaves. No leaf in Ceylon fetches a high price unless it is big; the quality of leaf also does not appear to be the primary consideration in valuing tobacco. The number of cigars a leaf will supply is the chief standard adopted. The leaves ought to be fairly well matured at time of harvesting.

The treatment to produce thick heavy tobacco for chewing is different from the above. The plants should be topped early and liberal watering given after topping. This enables the leaves to grow longer, broader, and heavier, by preventing early maturing. They should be harvested when well ripe.

The question of spacing was studied in other countries, and it is found that close planting produces fine leaves, and wide spacing favours the formation of heavy leaves.

#### HARVESTING.

The time for harvesting is decided by judging the maturity of plants. When a large majority of plants are ready for harvesting at the sacrifice of only a few, the time is opportune. The ripeness of plants is judged from the colour and appearance of leaves and stalks. The leaves should break when folded and passed between the fingers in the mornings. The stalk should crack when split with a sharp knife. Experience alone can guide the operator.

#### METHODS OF HARVESTING.

There are two methods followed locally, either (1) the leaves are cut with the stem between internodes, one by one, working downwards; or (2) the whole plant is cut first and allowed to wilt a few minutes, and the leaves are then cut off, starting from the base, with the stalk. The methods adopted in other countries are of two kinds: (1) the whole plant method; (2) single leaf method.

(1) *The Whole Plant Method.*—The stalk is split from the top with a tobacco cutting knife up to 4 inches from the base. It is then cut across at the base, and the harvested plants are

strung on laths  $3\frac{1}{2}$  feet long,  $\frac{1}{4}$  inch thick, and  $1\frac{1}{2}$  inches broad. Four to five plants are put on one lath.

(2) The *single leaf method* (or priming) consists of picking the leaves as they mature from the bottom one by one and stringing them on twine, which is passed through the lower midrib of the leaf with a needle of the size used for stitching gunny bags. These leaves are hung on the tobacco lath. The advantage in this method is that the leaves are harvested at the right stage of ripeness, and all the leaves are saved. As the leaves are harvested from below, the top leaves grow bigger, and the yield is greater. This method is more expensive, and pays only when the tobacco sells at a high price.

The whole plant method is the more usual way in which tobacco is harvested. The tobacco should be harvested in the mornings, after the dew has dried off. The presence of dew on the leaves at time of harvesting prevents a bright colour while curing. The plants are cut and allowed to wilt in the sun for a few minutes. This wilting makes the leaves soft and easy to handle in transport. Otherwise the leaves break and are spoiled. The plants should not be allowed to remain in the sun too long. If allowed to remain too long, they become sunburnt, and black spots appear on the sunburnt portions after curing. Harvesting in the evening, piling the plants in the sheds in two layers, and hanging them up in the morning is also good. During the night the leaves wilt, and begin to turn yellow or brighter in colour when laid in thin piles. They must not be piled deep, as they will begin to ferment and become useless.

#### CURING.

The curing is carried on by rule-of-thumb method at present. In order to cure well, the operator must understand what physiological effect the curing produces on the plant. The whole year's labour will be in vain if at this stage great care be not bestowed on the crop. Curing, like manuring, ought to be directed to suit the customers. When the White Burley tobacco, which has been found to be the variety suited to the European market that gives the best results at Jaffna is cultivated on a large scale, it will become imperative that cultivators should cure by a uniform method.



FIG. 1. -MANURIAL EXPERIMENTS WITH TOBACCO, JAFFNA.



FIG. 3. -CURING SHEDS AT JAFFNA--ONE IN COURSE OF CONSTRUCTION.



FIG. 2.—WHITE BURLEY TOBACCO BAGGED FOR SEED, JAFFNA.

There are four ways of curing tobacco : (1) Flue curing ; (2) open fire curing ; (3) sun curing ; (4) air curing.

The *air curing* method is the easiest and the least expensive, though it is slow. There are two stages. In the first stage the leaf turns yellow or bright coloured. This is known as the yellowing period. At this stage the leaf is still alive. The connection between the root and the plant is cut off and the leaf utilizes the stored plant food, converting starch and other carbohydrates into other compounds and eliminating water. The chlorophyll disappears and the leaf yellows. At this stage the most favourable condition for curing is humid warmth. The absence of moisture dries the leaves before they have had time to yellow and they cure green. This stage goes on for four or six days if cured according to the air-curing method. After this the leaf dies and turns brown. At this stage the leaf should be quickly killed and the colour fixed. The room should be well ventilated, and the doors should be kept open in the day. Gradually the midrib dries up, followed by the stem. This stage takes about ten days. The leaf retains that bright colour which it last had when it died, and therefore as soon as the leaf yellows it should be killed.

The local cigar variety was cured in this manner, and was found to be bright coloured and better flavoured than when cured in the local style. At any rate, the local cigar variety gives better results when thus cured, and the method is therefore recommended for adoption by cultivators.

#### AIR CURING.

An air-tight room or a shed with all the sides made airtight is necessary. The leaves which are harvested by the whole plant method are hung on laths as explained. These laths are placed about 6 inches apart on tiers. Stairs may be arranged according to the height of the room, and the laths may be placed on tiers, which form as it were storeys in buildings. During the yellowing period the doors should be kept closed, and as far as possible no outside air be allowed to enter. The leaves then cure slowly. The doors are opened in the mornings for a few minutes to examine how the curing proceeds. If the curing is fast, the laths should be set closer;

and if the curing be too slow, the laths should be shifted further apart, and the doors kept open for a longer period. After the leaves begin to die, *i.e.*, after they begin to turn brown, the doors should be kept open during the day. This dries up the plants rapidly. In about fifteen to eighteen days the plants will have been cured, and will be ready for stripping and grading.

#### STRIPPING AND GRADING.

At present stripping may not find favour. The country has become accustomed to judge tobacco by the portion of the stalk the leaf bears. It is very unwise for the cultivator to allow the stalk to be removed along with the leaves. The stalks contain a large percentage of potash, which will serve as valuable manure for the next crop. The cultivator cannot afford to lose such a large quantity of manure, which is ultimately thrown away and wasted. A large quantity of stalks are sent to Travancore with the exported leaves. Here the cultivator not only loses his manure, but pays freight charges on it to Travancore. According to the method recommended, the leaves are separated from the stalks and graded according to quality and size. There are five grades in the White Burley plant, but the Ceylon types have three grades, namely, the lower trash leaves, the middle leaves, and the top leaves. These are tied into bundles, called hands, with another leaf. After the tobacco is tied into hands it is ready for fermenting.

#### FERMENTING.

A raised board or a bench is selected, or the laths are placed side by side on a raised support to form a platform. Over this the hands are bulked. The bulk is now covered with gunny bags and shut off from the air. It is sometimes advisable to apply weight on the bulk if fermentation, which is indicated by a rise of temperature, does not set in. When the bulk gets too hot, it should be re-bulked, reversing the position of exposed and inclosed hands. The re-bulking should be done three or four times, and the tobacco is then ready for the market. Care should be taken that curing and fermenting be carried out in places free from bad odours.

## SUMMARY.

The following recommendations are offered:—The beds should be prepared one month before sowing of the seeds. The beds should be sown early. For Jaffna the last week in September to the middle of October is the best period for sowing. Boiling water should be applied to beds if they are suspected of being infected with fungus spores. The beds should be placed on raised land free from shade and should be protected from south-westerly winds. One basket of rotten well-powdered cattle manure should be applied to a bed 3 feet by 6 feet. The seeds should be graded before sowing. Only heavy well-matured seeds should be used. The seeds should be mixed with fine sand or wood ashes to give bulk for sowing. One teaspoonful of graded seed is sufficient for 100 square feet of bed, and gives a sufficient number of plants for an acre. The bed should be stirred to 3 inches before sowing, and weeds removed. The bed should be trampled with the feet to cover the seeds. No clods of cattle manure should be allowed to remain on the bed. The beds should be shaded with cadjans during the day between 9 A.M. and 5 P.M. till the seeds germinate. Seeds begin to germinate from the sixth day. If the days are cloudy, no shading is required. The beds should be kept moist, but not damp. The watering should be done with a fine rose spray. Weeding should be done by hand after the plants have come up. Pricking is recommended, as strong, healthy, disease-resisting, vigorous plants are produced by this means, which stand transplanting better and are ready for harvest earlier. Pricking should be done in rows  $1\frac{1}{2}$  inches by  $1\frac{1}{2}$  inches. The seedlings should be hardened for a few days before transplanting. The beds should be well moistened before the seedlings are drawn. Transplanting should be done in the evenings and at all times of the day if the weather be cloudy. The roots should be placed in transplanting as they grow in the bed. Bending of the tap root injures the plant. Only the bud should be allowed to appear on the surface, with the leaves covering it. The longest leaf of the plant should be about

4 to 5 inches. Watering should be done very sparingly for a month to enable the plants to send down their roots in search of water and thus develop a good root system. Watering should be done at first in the manner described in pits. The plant should be encouraged to grow rapidly after a month from transplanting, when the land should be cultivated with the local plough or Planet Junior cultivator between rows. Irrigation channels should be opened between rows and watered as described. Topping should be done either late or early, depending on the nature of leaf required. If topped early, the leaves get thick ; and if topped late, fine in texture. A heavy soil produces heavy leaf, and a light soil light leaves, which burn well. The plants should be suckered as the buds appear. The best plants should be allowed to go to seed for the next season. The plants should be harvested according to the whole plant method, and cured by the air-curing method. Leaves should not be taken with the stalk. The leaves should be stripped after curing and be well fermented before selling.

W. P. AMIRTHAM COOKE.

March 12, 1918.

---

*Erratum.*

In Bulletin No. 36, for "Per Cent. Scrap," as heading in tables on pages 6, 7, 8, and 9, read "Per Cent. Caoutchouc."

